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SUMMARY OF THE PROCEEDINGS OF THE ANNUAL AMC PACKAGING SEMINAR (1ST) HELD AT UNITED STATES ARMY NATICK LABORATORIES, ON 19-20 SEPTEMBER 1972

Joseph P. Akrep

Army Natick Laboratories
Natick, Massachusetts

May 1973

AD

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SUMMARY of the PROCEEDINGS of the FIRST ANNUAL AMC PACKAGING SEMINAR held at US ARMY NATICK LABORATORIES 18-20 September 1972

Edited by

Joseph P. Akrop

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13. ABSTRACT

The First Annual AMC Packaging Seminar was held at the U. S. Army Natick Laboratories on 19-20 September 1972, and was attended by military and civilian U. S. Government personnel, including civilian government representatives from Canada, who were interested and generally engaged in the area of packaging, packing, and preservation of material.

The Seminar was intended basically as a general forum for exchange of ideas and information on packaging matters, with interested elements reporting on their problems and progress in areas of packaging R&D, Production Engineering, and Standardization. Papers were presented by representatives of the U. S. Air Force, Navy, and Marine Corps for an overview of their efforts, by AMC Commands and Laboratories to illustrate their commodity based areas, by distribution and storage representatives, by procurement agencies and activities, and by agencies involved in pollution abatement asepects of packaging. The format consists of summaries in the interest of brevity.

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FORMAT

The format consists of summaries in the interests of brevity. For more detailed information on the subject matter presented, the speakers should be contacted directly. The summaries are shown in the order the presentations were made, by session, to preserve continuity of subject matter.

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US Army Munitions Command	Mr. S. J. Porter Munitions Engineer Engineering Support Division, Research and Engineering Directorate U.S. Army Munitions Command
US Army Aviation Systems Command	Mr. E. Conlin, Packaging Division Directorate of Materiels Management U.S. Army Aviation Systems Command
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Defense Contract Administration Service	Mr. J. R. Green Packaging Specialist Office of Transportation & Packaging, Defense Contract Administration Services.

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US Navy - Naval Supply Systems Command	Mr. Donald Jermain Project Manager Research & Development Office. Naval Supply Systems Command
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Johnson, Hazel W. LTC	US Army Medical Research & Development Command
Kaido, Michael J. LTC	US Army Combat Development Command - Infantry Agency
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Brewer, Jerry MAJ	US Army Medical Research & Development Command
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Anderson, David L.	US Army Missile Command
Bowman, Marlin	Naval Supply Systems Command
Brugh, Joseph F.	Naval Logistics Engineering Group
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Caccamise, Francis	US Army Munitions Command, Joliet
Clifford, Marion	US Army Logistics Command, Atlantic

Conlin, Edward	US Army Aviation Systems Command
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Jankowski, Stanley R.	Joint Military Packaging Training Center
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McFate, Samuel	US Army Weapons Command
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Nakaue, William	Defense Personnel Support Center
Noe, George	Defense Personnel Support Center
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Stewardson, H. F.	Canadian Forces
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Thornton, Rozier L.	Defense General Supply Center
Turner, Wendell	US Army Materiel Command

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Toman, John W.	General Equipment & Packaging Lab
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Troisi, Ferdinand L.	General Equipment & Packaging Lab
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Wisniewski, Stanley G.	General Equipment & Packaging Lab
Witt, Marilee D.	General Equipment & Packaging Lab

Session A.

SUMMARY OF THE PROCEEDINGS OF THE 1st ANNUAL

AMC PACKAGING SEMINAR - 19-20 September 1972

Mr. James H. Flanagan
Acting Technical Director
U.S. Army Natick Laboratories

Mr. Flanagan welcomed the participants to the Seminar and pointed out the importance of the mission at Natick for both packaging R&D and procurement support. Natick Laboratories' packaging mission has had a broad base in support to many agencies and the services, and has successfully performed on the many demands for its expertise in the past years.

B.G. John C. McWhorter, Jr.
Commander
U.S. Army Natick Laboratories

General McWhorter welcomed the attendees to the Seminar and discussed Natick Laboratories' basic interest in implementing AMC's directives in the area of a cooperative packaging program. The initiation of an Annual AMC Packaging Seminar is an important step in the development of a progressive and forward looking program which will encourage the exchange of ideas and information to aid in the solution of the Army's packaging problems. NLABS will assist the Commands in any way possible as desired in the development of the new R&D programs.

LTG Woodrow W. Vaughan
Deputy Commander AMC

Gen. Vaughan discussed AMC's interests and requirements in the development of a progressive and viable AMC-wide packaging R&D program. Viet Nam has demonstrated that packaging is critical to the delivery of supplies in condition for use, especially in the difficult environment encountered in that area. It is apparent that packaging is a high value area and is a broadly applied discipline, being required for everything we buy or ship. We estimate that AMC spends close to a 1/2 billion dollars per year for packaging. The expertise which provides this engineering discipline is represented by the group attending this Seminar. These are the people to whom we look for our packaging future. In view of our austere budget and the reduction of effort overseas, we must strive for maximum cost-effectiveness, and must depend on the packaging expertise available to utilize new ideas, materials, methods, and equipment which will provide adequate protection to our materiel at minimum cost. We hope that this Seminar will be an important step forward in that process of contact, coordination, and exchange of new ideas and information, and will be the forerunner of a successful series of Annual AMC Packaging Seminars.

Dr. Edward A. Nebesky, Director
General Equipment & Packaging Laboratory
US Army Natick Laboratories

Dr. Nebesky stated the seminar was the first of a series of annual seminars held at the request of the Deputy for Laboratories, AMC. He further indicated that NLABS supported the concept of an annual meeting of interested DoD packaging personnel.

He stressed his feeling that the Seminar should provide a forum for exchange of ideas, better understanding of packaging in relation to the overall logistics system and appreciation of the problems, and restraints which exist in areas of procurement, storage, transportation and development.

Only through frank and open discussions at meetings such as this can we hope to arrive at acceptable solutions to military packaging problems. No group represented at this seminar can work alone. All must work together with a common goal: provide the most efficient packaging at a minimum cost in support of the DoD mission.

Session B.

Mr. Richard H. Davis
Packaging Specialist
Materiel Division
U.S. Army
CDC Supply Agency

Mr. Davis discussed various aspects of the CDC Supply Agency interests:

1. The supply picture from CDC's viewpoint touches upon three related areas:

a. Packaging which provides the environmental and physical protection necessary to ship and store materiel wherever required.

b. Unitization which provides means for rapid handling with M.H.E. (materials handling equipment) as well as assist the field in storage and transportation.

c. Containerization which provides the van consolidation to incorporate supply, transportation, security, packaging, and storage into the distribution system.

2. Packaging can rarely be safely eliminated in container vans. Benefits are gained only where door-to door shipment is guaranteed, with proper packaging and storage within the van. Materiel must withstand superimposed loads and forces developed within the van during sea, rail, and truck shipment. Seven major hazards in container van shipment are: handling, highway, rail, ocean, water damage, contamination, theft and pilferage, and fire hazards. Also, where deck stowage is used, packaging may be subject to wave action, salt spray, hot sun, cold temperatures, high humidity, and condensation.

3. Two supply distribution concepts were discussed: one for a midintensity conflict situation, and one for a low level (peacetime) intensity conflict situation. Major variables were the stock levels, order-ship time, road and rail networks, tonnages involved, percentage deliveries direct to forward units, dispersion, and air superiority.

4. Implementation of these concepts would require consideration of several problems and general field requirements when contemplating reduction of packaging or design of unitized loads:

a. Any reduction of packaging is a high risk area, and adequate protection must be assured, regardless of the supply system used.

b. Some temporary storage or holding of supplies is always necessary, and in the absence of covered storage, adequate packaging protection must be assured.

c. Unitized loads must be easily handled by M.H.E., and must be modular to the van to facilitate stuffing and stripping. Packaging protection is also an essential feature of the unit loads.

d. Van stuffing procedures should allow vans to be stripped rapidly with M.H.E. Manual stuffing will require unloading and therefore additional manpower, thereby slowing down the supply operation the field considerably.

e. Container van distribution systems must recognize that not all units receiving supplies have M.H.E. to handle all sizes of loads. Generally, as supplies move forward, the availability of M.H.E. decreases and the reliance on manual handling increases.

LTC. Michael J. Kaido
Project Officer
Combat Materiel Division, USA
CDC Infantry Agency

Lieutenant Colonel Kaido's presentation included an expression of Infantry problems, requirements, and recommendations for improvement of ammunition packaging.

The inherent problems of transporting and preserving ammunition in a combat environment are compounded by the need for easy access and repackaging. Compatibility with other load-carrying equipment is a necessity as the infantryman may be required to carry ammunition along with other combat and personal gear for extended distances and times. Currently, much of the Soldier's ammunition is carried in such a manner that protection or preservation is sacrificed for availability. Most of the protective packaging is discarded by the combat Soldier because it is heavy or bulky, not reusable, or it otherwise impedes combat effectiveness.

Future ammunition packaging efforts should consider disposable magazines for small arms, lighter, variable, individual loads; weatherproofing at the lowest (user) packaging level; snap-open, resealable containers; and lightweight bulk packaging. While improvements of this type may increase the per-round cost of ammunition, significant savings should accrue from reduced shipping costs and reduced amounts of unserviceable ammunition. From an operational viewpoint, ammunition will function reliably and can be readily employed, thus enhancing the capability of Infantry.

Mr. Jack E. Thompson
Deputy Director for Packaging
Headquarters AFLC

Mr. Thompson's presentation covered several efforts currently being pursued by the Air Force to improve packaging:

1. The Air Force Reusable Container Program.

a. The Fast Pack Concept reduces the many types and sizes of containers and cushioning materials being used by eliminating a wide variety of packs which had been used at the various AMA's for items of similar configuration. Further development during the Fast Pack II program resulted in many improvements and design innovations, such as the Tee Pack, Cross Pack, Slide Pack, and Star Pack. The advantages of this simplified approach have resulted in wide use and a quarter million dollar first year saving in conjunction with GSA action for Air Force items. The implementing directives have included all the information required by packaging personnel, such as Fast Pack selection charts which describe all material required, design features, preservation, cushioning, and marking for a large group of high volume repair cycle items.

b. Standardization of Fiberboard Containers has been achieved chiefly through two programs: first, for sizes-style-type-class-variety-and-grade for those items which do not require double-wall or triple-wall board; and second, for containers with cushioning as an integral part of the pack. The sizes have been reduced from 436 to only 83, all in RSC, single-wall, V3c, corrugated, and weather-resistant. The cushioned pack system is especially applicable to those items which are recoverable and repairable, or about 80,000 line items for the Air Force.

c. A Container Design Retrieval System is under development to provide uniform submittal, storage, and retrieval of container design information, particularly in the area of specialized reusable containers within the Department of Defense. Heretofore, the packaging design data acquired and stored by the Air Force and DDC could not be selectively retrieved in terms of characteristics of the item to be packaged, or in terms of the required characterisitcs, configurations, and capabilities of the package necessary to protect the new item. The system being developed will provide the documentary tools to generate a useful input into DDC, and allow interrogation of the DDC data bank on any of several inputs, so that the desired design information can be retrieved.

2. Packaging Development Contract Effort

a. Plastic Structural Materials for the possible development of high performance, watervapor-proof plastic structural materials. An example is the use of a frothed epoxy foam which can be poured or trowelled and will provide both mechanical and environmental protection because of inherent toughness and closed cell nature.

b. Container Closure Devices are being investigated to provide a satisfactory closure device equalling the protection afforded by the flexible plastic material itself used in the body of the current flexible reusable containers for aircraft engines. The present available systems such as heat sealing, metal zippers, plastic/rubber sliders, pressure sensitive tape, and adhesives have various deficiencies such as limited reusability, difficult water vapor sealing, high cost, and complicated and/or difficult fabrication.

c. Idealized Cushioning Materials are being considered. Conventional cushioning materials are relatively inefficient and require large volumes of materials. An ideal cushioning material as defined

by the curves presented could reduce overall cushioning volume material requirements by as much as 75%.

3. Foamed-in-Place Packaging

a. Depot Level Operations have been implemented by the PACER FOAM project which examined and verified polyurethane foam-in-place packaging techniques and equipment for cost-effectiveness, reliability, production processes and materials. Large volume applications are included where machine generated foamed-in-place is required, and Sacramento AMA has established 2 pilot production lines with the required foam machinery and auxiliary equipment.

b. Base Level Operations will utilize a compact console type machine as a result of the successful conclusion of a joint AFLC/AFSC evaluation project at Patrick AFB. The foam used is a 1/2 pound per cubic-foot semi-rigid material, and the system is being expanded to other bases and depots.

c. Foamed-in-Place Kits have been developed by AFPEA using a hand-mix, flexible polyurethane material kit. It is intended for use at remote locations where the small number of sensitive repairable items being returned does not justify the more expensive base and depot level installations. This kit development will allow smaller field installations to take advantage of the cost savings and cushioning/packaging efficiency possible with the FIP system.

4. New Container Design Concepts may result as an end product of an aggregate of these various projects. As an example, an item could be packaged in a flexible water-vapor-proof package, using the flexible closure device for easy field maintenance and inspection and the idealized foamed-in-place material for shock protection. The item could then be packed into a structural plastic container with standard closure devices and, as required, any pressure relief valves and improved humidity indicators. The

goal in this area is a cost-competitive, lightweight, reusable container, corrosion and fungus resistant, wit. ready access, and shock and vibration protection.

Mr. Joseph F. Brugh, Director
Naval Logistics Eng'g Group
Naval Supply Systems Command

Mr. Brugh outlined NLEG's 5-year history, current programs, and mission in support of the Navy supply system, including the Mediterranean 6th Fleet and WESTPAC 7th Fleet. Problem areas are submitted by the fleet units to NAVSUP who assigns these to NLEG as approved projects; such as problems in packing and preservation, materials handling, warehousing, and storage. Currently, NLEG has 26 projects assigned. Some of the more important efforts are:

1. Shrink Wrap palletization has been evaluated to develop application methods and procedures and to correlate film thickness requirements with density of load. Advantages are improved protection and reduction in losses and cost of packaging. The equipment is being introduced into the Supply Center operations.

2. Liquified Petroleum Gas (LPG) as a replacement for the gasoline used as fuel for M.H.E. is being evaluated in two of the Supply Centers that are conducting operating and maintenance cost comparison tests under actual operating conditions. Tests at NLEG had indicated that pollution is reduced up to 90% when LPG is used in lieu of gasoline.

3. Impregnated fiberboard boxes were designed and tested for use in lieu of wirebound boxes for fresh produce shipped to the fleet. Tests and customer acceptance were very successful with some of the advantages being lower cost (save $.26 per box), easier stacking and handling, no protruding nails or wire, and longer shelf life for specific commodities.

4. A Shipboard Forklift Truck is required specifically for use in the holds of supply ships to eliminate excessive hand stowing and to maximize the use of palletized/ unitized loads. Specific requirements are: low profile, shorter turning radius, better stability, anti-skid tires, and non-ferrous critical metal parts.

5. Improved stowage aboard ship for hazardous materials which need properly protected spaces, and for spare parts in the critical area of aircraft and sophisticated electronics equipment.

6. Expendable Low Cost Pallets are being evaluated, such as softwood and impregnated fiberboard pallets with plastic legs. While cheaper, these pallets have limitations for shipboard use and underway replenishment.

7. Foamed-in-Place cushioning is under evaluation, especially for retrograde movement of electronics modules and spare parts from ships for repair or recalibration. Particular requirements for shipboard application are that the foaming system be completely safe and free from hazards such as explosion and toxicity.

8. Pollution Abatement/Packaging Reduction is a program to reduce the amount of solid wastes being dumped at sea by ships of the U.S. Navy. The goal is to reduce packaging waste from subsistence items aboard ship 50% by 1973 and 75% by 1985.

Mr. Robert L. Duckett
Packaging Specialist
Materiel Division
Hq., Marine Corps

Mr. Duckett discussed various aspects of the Marine Corps interests in packaging. An outline of the talk follows.

PACKAGING ADMINISTRATION

1. Organization

   a. Supply Department (Mission)
   b. Materiel Division (Packaging Responsibility)
      (1) Packaging Programs
      (2) Packaging Directives
      (3) Packaging Facilities
      (4) Intra-Relationships
      (5) Inter-Relationships
      (6) Packaging Training
      (7) Boards and Committees

2. Trends and Developments

   a. Foamed-in-Place Packaging
   b. Modernization of Facilities

Session C.

Mr. Clair L. McDermit, Chief
Packaging Engineering and Development Branch
USA-TACOM

Mr. McDermit discussed various generalized aspects of Packaging Management within AMC Commodity Commands and their implications for organizational structure and funding practices. The summary follows.

1. The lack of uniformity of organizational structure works to the disadvantage of both the packaging organization and overall management.

2. Nonuniform funding practices also lead to under-support and possibly over-support in some cases. This nonuniformity more importantly leaves management at all high levels without any management information upon which to base judgment and make decisions.

3. There is a need for a dispassionate, objective study of the subject of packaging organization and its related funding.

4. It is recommended that these two related subjects be given priority attention during the follow-up on the Care of Supplies in Storage (COSIS) Study.

Mr. Herbert Maas, Jr., Chief, Packaging
Development and Engineering Team,
Materials Research Division
MERDC

Mr. Maas discussed the MECOM programs as implemented at MERDC to perform packaging functions in support of the basic MECOM mission. Packaging support is furnished for all MECOM mission areas, such as electric power generation, engines, construction equipment, materiel and cargo handling, camouflage, bridges, and marine craft. The laboratory includes extensive facilities to support packaging and containerization programs, including a full-scale railway hump simulator, an automated vibration machine, and an environmental chamber. Areas of interest at the present time are:

1. Design and structural requirements for shipping and storage units for structural analysis of container design and related container stress evaluations as affected by new standards on reduced lumber sizes.

2. Preservation techniques for complex mechanical and electrical equipment such as internal preservation of internal combustion engines, mechanical power transmission assemblies, electrical power generation and control equipment, and hydraulic systems.

3. Families of single-round-trip containers, such as molded polystyrene or similar construction, for the packaging and preservation of field-type power generating equipment and accessories.

4. Determination of the effects on packaging requirements of the new antipollution devices on internal combustion engines.

5. Development of criteria for maximum cube utilization in containerization media, since general

"stuffing" procedures waste cube and manpower and result in damage.

6. Modular van system utilizing various sectionalized van design approaches to allow maximum flexibility in the distribution system.

7. Specialized van blocking, bracing, and compartmentation procedures and hardware for high density, sensitive, and/or critical supply items.

Mr. Frank J. DePalma, Chief Packaging Branch,
Distribution and Transportation Division
ECOM

Mr. DePalma discussed ECOM packaging management operations to include consideration of (1) mission responsibilities as defined by the applicable regulations; (2) training programs such as ECOM management training, preproduction conferences with industry and industry seminars, USALMC and JMPTC; (3) standardization programs such as engineered packaging specifications for major items of supply, and repair parts packaging in accordance with the Packaging Requirements Code; and (4) the Cost Reduction Program as implemented by the use of packaging cost data obtained from packaging service contracts as a comparative tool for the economical procurement of packaging.

Some of the recent accomplishments and items of interest to ECOM are:

1. ECOM mission requirements have been supported by revision of the manuals on rapid development, redeployment, and retrograde of equipment (TM 750 series), and by development of requirements for 164 documents such as specifications and standards. Testing and engineered design development of blocking and bracing for shelters resulted in two standardized "Packaging of" documents which eliminated varied narrative instructions in over 50 military specifications in this area.

2. All packaging support to procurement has been processed on schedule. Of the total of 113,663 ECOM active items, 63% have been included in the

packaging segment of the Army Master Data File. Data on new items and weight/cube data from the depots is also programmed for inclusion into the AMDF to meet supply system needs. Cost reduction in packaging reached $172,000 which was 72% in excess of the goal. The packaging service contracts are the key to ECOM's cost control system, since they provide the basis for cost comparison. Revision has also been made to the manual on the "POMCUS" program for storage and maintenance of prepositioned material configured to unit sets.

3. ECOM participated on the DA Survey Team in support of the COSIS program(Care of Supplies in Storage), and DCS/LOG commended all participants for their efforts. ECOM furnished a member on the ad hoc Committee for revision of AMCP 706-121 "Packaging & Pack Engineering Handbook".

4. ECOM participated in preparation of the Packaging Technology Review which was presented to Deputy CG-AMC. The purpose was to study overall packaging programs, progress, and problems and to propose necessary action for improvement where indicated, including R&D effort. Findings were (a) that packaging represented a 30-billion-dollar industry nationally, and that military packaging costs range from 1.1 to 14% of procurement costs, (b) that the military must take the lead in R&D effort, since AMC requirements are more severe and unique to military operations. The Commands have done little basic R&D in packaging, and an innovative R&D approach is needed to provide fundamental needs in this area, (c) that inconsistencies still occur in specifications, and a need exists to develop basic minimum performance requirements, (d) heavy losses of material occurred in WWII, Korea, and Vietnam where commercial packaging was used because of availability, (e) each Command will analyze

its own position and requirements on an annual basis to achieve AMC objectives through the medium of the Packaging Seminars.

5. ECOM reported to the Packaging Seminar that a detailed outline had been prepared for personnel and resources required in support of the AMC objectives in "Packaging R&D" and "Standardization" and has been reviewed by an AMC Packaging Manpower Survey Team. ECOM's recommendations for consideration at the Packaging Seminar are: (a) establish priorities within the assigned mission responsibilities of each Commodity Command, and (b) develop milestones for completion of the identified programs to enable maximum effectiveness in allocation of resources to meet program objectives and due dates.

Mr. David L. Anderson, Packaging Coordinator, Packaging Division, MICOM

Mr. Anderson discussed various aspects of Missile Command interests in packaging problems, programs, and requirements as follows:

1. Problems

a. Recruitment of personnel to fill vacancies created by retirement of 2032 specialists.

(1) Philosophies of "Age In A Workforce".
(2) Grade Creep Block.

b. Standard Integrated Support Management System (SISMS) (Part 21):

(1) Scope.
(2) Implementation.
(3) Impact at MICOM

2. Programs and Requirements:

a. Completed RDE Projects:

Fabrication and test of three reusable containers for missile system secondary items which resulted in cost reduction validated savings of $242,900.00 in FY72.

b. Current Projects:

(1) Continued testing of a wooden container that would replace a costly designed container being used which will result in cost reduction for FY's 73, 74, and 75.

(2) Project MASSTER Quick-Dump Exercise.

(3) Manufacturing Methods And Technology (MM&T) Program.

Mr. S. James Porter, Munitions Engineer, Engineering Support Division, R&D Directorate, MUCOM

Mr. Porter discussed various aspects of Munitions Command interests in developments in ammunition . packaging:

1. Under a joint Natick Laboratories/USA Munitions Command exploratory development program for munitions packaging we have initiated work unit 004: Fire Resistant Packaging System for Munitions. It's objective is to provide materials for packaging that will, in addition to possessing other properties, be fire-resistant and retain this property under outdoor storage conditions.

2. Earlier work done to impart fire resistant properties to wood resulted in some effective methods; however the processes were not cost-effective, and efforts continue to develop more economical methods.

3. A study is underway directed towards up-grading the packaging of small arms ammunition. Several concepts have been considered. Objectives are to lighten the load of the Infantryman while at the same time providing better protection for the ammunition.

4. Under the Small Arms Ammunition Modernization Program an automatic pack-out line has been developed. It has the capability of packaging 1200 rounds per minute with a minimum of operator assistance.

Mr. Edward J. Conlin
Chief
Packaging Support Branch of Packaging Division
AVSCOM

Mr. Conlin discussed AVSCOM interest in packaging, especially with regard to the major area of effort, that of packaging, shipment, and storage of Army Aircraft and components.

1. Prior to the Vietnam era, no one had ever prepared and shipped large quantities of aircraft over long distances. As a result, it was necessary to develop new methods of disassembly, preservation, and packaging which would reduce the manhours required for reassembly at the delivery point to place the aircraft in a flyable condition.

2. a. For surface vessel shipment, full level A was utilized for preservation of all engines, gear boxes, and hydraulic systems. Cocooning of the entire aircraft was accomplished with a strippable coating.

b. For air shipment, little or no preservation was performed, with all effort going into the design of fixtures to reduce shipping cube:

(1) The "side saddle" system, which allowed loading 50% more UH-1's (Hueys) into C-141's by removing and reversing the tail booms and "hanging-on" the fuselage. This procedure saved over $1,000,000 in transportation costs.

(2) The "shipping-skid" (Cobra) reduced the aircraft width from 88 inches to 56 inches, allowing 50% increased loading in C-141's.

(3) The "shipping skid" (OH-58 aircraft) allowed 33% increased loading in C-141's.

3. a. Major recent AVSCOM interest is in retrograde aircraft preservation, temporary storage of aircraft awaiting overhaul, and long-term storage of aircraft.

b. For short-term storage (i.e., 6 months for retrograde and overhaul), AVSCOM is testing a sprayable acrylic coating which costs less than 30 dollars per aircraft, in lieu of the previous cocooning system.

c. For long-term storage, a number of options are available:

(1) Storage in a desert area (approx. 1200 aircraft at Tucson)

(2) Driclad ($2000 per aircraft)

(3) Cocooning with dynamic dehumidification ($1,200 per aircraft).

4. A major effort at the present time is in the development of a family of lightweight reusable containers for critical and high value aviation components. In one example, a Chinook servo mechanism had been packaged in a metal drum with molded interior cushioning. A new molded fiberglass container saves 62% in weight and 87% in cube and is much cheaper in initial cost and transportation costs.

Mr. Samuel A. McFate
Preservation-Packaging Specialist, Packaging
Engineering Branch
WECOM

Mr. McFate discussed various aspects of WECOM's packaging efforts.

1. WECOM's packaging mission, responsibilities, and organizational structure, including the Benet Weapons Laboratory-Watervliet; the Tools and Equipment Directorate - Rock Island Arsenal; Frankford Arsenal; and the Weapons Laboratory - HQS WECOM. AWC packaging personnel are responsible for the design, development, and establishment of preservation, packaging, and packing requirements, with the attendant documentation for all mission material and other assigned items. WECOM applies the Configuration Management Programs for all detailed packaging operations and documentation, which includes 25,000 detailed packaging data sheets.

2. FY72 major effort was concentrated on supporting the packaging requirements of Technical Data Packages for Procurement. About 4200 procurement actions were processed during the year, with 4700 procurement actions anticipated for FY73. Packaging documentation for each procurement action provided up-to-date data for current packaging materials, processes and procedures. Other efforts during this fiscal year were centered on preparation and review of packaging specifications, resolution of contractual problems, assistance to DoD/AMC survey teams and committees, and conducting surveys at depots.

3. FY72 Cost Reduction Programs in packaging resulted in savings of $107,200, which was 214% of the assigned goal, and primarily realized by (a) use of automatic packaging equipment versus manual operations, (b) new criteria for levels of protection to be applied, (c) reduced labor for the assembly of the Truck Hardening Kit, and

(d) package redesign of the barrel and front sight assembly for the M16A1 rifle.

4. FY72 packaging program innovations included new automatic packaging equipment at Watervliet and Rock Island, such as automatic packaging machines for parts, small parts bagging machines, foamed-in-place equipment, and automatic "skin" packaging machines. Future plans include a pallet load shrink chamber, a parcel post shrink tunnel, and a modern foamed-in-place dispensing unit.

5. The FY73 workload and programs are extensive and require priority determinations in view of the limited resources available for package engineering, both in funding and work accomplishment. Effort will include (a) New Basic Issue Items (BII) and Sensitive Cargo requirements as directed by AMC which will require complete revision of many existing documents, (b) Depot overhaul/rebuild programs require extensive revision and updating of packaging requirements, (c) Implementation of SISMS (Standard Integrated Support Management System) will create a complex problem in the handling and processing of coded data systems, and (d) Necessity for a program to allow replacement and/or training and development of specialized packaging personnel as an Army Career and Training Program to provide technically competent replacements for the high-average-age work force in this area.

6. Research and Development plans for: (a) a WECOM pilot pack facility: (b) a WECOM package test and evaluation facility; (c) a program of development of improved packaging for the Small Arms Family of Weapons; and (d) a development program to generate design and engineering criteria on blocking and bracing of WECOM major items for rail and truck shipment.

Mr. Frank J. Rubinate
Chief, Packaging Division
General Equipment and Packaging Laboratory, NLABS

Mr. Rubinate discussed various aspects of Natick Laboratories' packaging program including the areas of research and development, production engineering, and standardization. Most of the packaging R&D program is concentrated in the exploratory development area, where an applied research/breadboard hardware approach leads to solutions to specific problems with the determination of feasibility, practicability, and parameters of the particular problem.

Since the project development process tends to be highly innovative, there can be extensive spinoff to the civilian and industrial sector. One good example is the on-going flexible packaging program. This development has reached the point where "reliability/production test" runs are being conducted under the Swift consortium contract, and have generated intense interest in industry. Several hundred attendees are expected at the Flexible Packaging Symposium which will be held at Oak Brook, Illinois, in November 1972 under the joint sponsorship of the National Research Council and NLABS.

Other related effort includes research on (1) Acceptance levels and criteria for flexible packages for heat processed foods (2) Multi-serving units (3) Automatic systems to form, fill, seal, and handle packages of thermoprocessed foods (4) Packaging for small group feeding systems, and (5) Dimensional and density parameters for modular containers for convenience foods.

As another example of possible spinoff, an in-house laboratory research project in a completely new area, calorimetric detection of bacteriological contamination of thermoprocessed food packages, may provide a rapid

nondestructive test where none existed previously, and commercial producers are now showing intense interest.

An important development is the munitions packaging exploratory development program now underway for the Munitions Commands on related areas of effort, such as moisture protective systems and plastics. This type of effort may have important implications for the new programs for packaging research and development for the Commodity Commands now under consideration by the AMC Director for Laboratories.

Production engineering effort includes (1) Support to Operations Research/Systems Analysis for the Fort Lewis project in the Centralized Food Preparation Facility, (2) Condensation on Shrink Film Palletized Loads, and (3) General Technical support to the procurement activities.

Session D.

Col. Raymond A. Cramer, Jr.
Project Manager, Surface Container Systems,
AMC

Col. Cramer's presentation highlighted the mission indicated project milestones, and covered the current status and program of the milestones. Basic items of hardware that support the system were presented and planned; future developments were highlighted. The briefing culminated in a discussion dealing with the relationship of level of protection to container shipments, particularly in view of instructions contained in DODI 4500.37 which strongly urges the full exploitation of container shipments. It is felt that greater progress can be attained in the level of protection reductions for shipments moving by container if a policy is issued which directs all DoD activities to base the level of protection on the assumption that all supplies will move via container instead of determining level of protection on historical data from depot operations, which is the system currently in effect. Present rationale is based on the hypothesis that if an overpack would be required to meet a low percentage of cargo that may move breakbulk, it would be offset by the trade-off of cost to pack to a higher level based on historical performance of depots which in some instances ship, by necessity, level A protection in containers. This negates the inherent advantage offered by container shipments. As a minimum, a one-year test of this proposal should be undertaken and data collected to determine impact and the validity of the hypothesis.

Of particular interest are the tests planned, the projected R&D requirements, and the development of

doctrine, concepts, and procedures for all operations, such as helicopter support, carrier discharge, and Logistic over-the-Shore Movement (LOTS). Other important test areas are the ammunition related programs, to include extensive shipping tests by all services. Equipment tests and/or development planned include (1) Small closed modular containers, (2) Reefer containers for subsistence and medical supplies, (3) Open flat racks for structural lengths such as lumber, pipes, beams, and (with special fittings) for TRICONS, military vehicles, tractors, (4) Bulk liquid containers for fuels, lubricants, flowable materials, and (5) Loan of 1000 MILVANS to various agencies to test and develop container concepts and/or obtain the benefit of operational economics.

Operating procedures and concepts are also under development, such as distribution concepts, tonnage projections, contingency plans, movement control systems with automatic sensing and reporting of container movements, preparation of operating procedures and DoD instructions, evaluation of "The Electronic Label Logistic System", plans for marshalling areas and associated facilities required at dockside and/or factories, and standards for packing and preservation of supplies for shipment in surface containers.

Col. Matthew R. Wagner, Chief,
Storage and Transportation Division
Supply Directorate
AMC

Col. Wagner discussed various packaging aspects in storage, distribution, depot operations, and related areas of effort such as:

1. Packaging costs in AMC Depots approximate $40,000,000 per year, of which 80% is labor, in processes which are little changed since WWII. In winding down the effort in SEA, we are involved in preservation and maintenance of thousands of tons of retrograde materiel. New machinery and equipment provide a great potential for cost and labor saving without sacrificing item protection, and these include automatic packaging machinery, pallet shrink chambers, and foamed-in-place processes.

2. Availability of R&D funds for depot operations would have an important cost and performance impact in areas such as (a) Films for all preservation methods in conjunction with the automatic packaging machine, (b) Foamed-in-place techniques to include opening and closing systems, and foam variables such as low densities, VCI inhibitors, and elimination of toxicity (c) Low cost inhibited shrink films and specialized procedures such as shrink processes for 463 L pallets, (d) New exterior containers, (e) Automated marking systems, (f) Vehicle processing equipment, and (g) Improved preservation techniques for aircraft.

3. The automated packaging machine concept would have important cost saving implications because it would replace 7 methods in MIL-P-116 at a major saving in both original procurement and in depot operations. Foamed-in-place is another bright prospect which is expanding rapidly, and some agencies have made impressive savings through utilization of foamed-in-place. Additional effort in opening

and closing systems, VCI treatments, low density, and elimination of toxicity will further expand areas of use.

4. The introduction of pallet shrink-film chambers into depots has brought in a new era of savings, especially as an economical method of bonding pallet loads. Another very useful application is as a replacement for fiberboard multipacks by utilizing an 8-mil shrink bag with an expendable pallet. The areas requiring additional work are retrograde loads, 463L shrink systems, ultra violet inhibitors, and condensation problems.

5. Effort is needed for the development of new, strong, lightweight exterior containers to replace the many types in use at the present time, for reduced weight and cube, and reduction in inventory of containers. An additional benefit may accrue in the possible simplification of levels requirements.

6. Marking of containers by manual application of stencils and labels is a time-consuming and costly process which should be a fertile area for improvement, especially through automation. Several automatic systems are possible, including computer controlled laser marking, which could result in improved marking operations to include elimination of manual tasks and minimizing marking deficiencies due to human error.

7. Low cost efficient techniques are required for the protection of vehicles and equipment from deterioration while in outdoor storage. Present fogging equipment was not designed for diesel, multifuel, and turbine engines. The COSIS review also indicated the need for automatic exercising systems, especially for combat vehicles, to include hydraulic, mechanical, and pneumatic systems in the recoil mechanisms, vehicle

suspensions, and various gear train actuated assemblies.

8. Aircraft preservation procedures are a major area of effort in view of the high unit cost, and the necessity for immediate use capability from storage. Protective finishes are required which will eliminate the need for preservation of the outer surface; and also low cost, reusable, portable controlled atmosphere storage enclosure systems to reduce depreservation time and cost and to increase materiel readiness.

9. In addition to depot operations, the Supply Directorate is also involved in standardization, to include review of packaging documentation and management of the PACK area which has been assigned to AMCPSCC at Tobyhanna Army Depot. Further effort is required in the implementation of guidance for (a) Selection of levels, (b) Selection of appropriate exterior containers, (c) Unitization and palletization requirements, and (d) A Packaging Management System as assigned by DoD.

Mr. Robert Kennedy
Specialist for Shock and Vibration
U.S.A. Transportation Eng'g Agency

Mr. Kennedy discussed various aspects of transportation engineering and responsibilities in the packaging area:

1. Packaging, Supply, and Transportation Engineering functions are all interdependent. Each must act in relation to the other to obtain system progress. A gain or benefit in one area that produces a loss in time, increase in cost, or decrease in military effectiveness in the supply-packaging-transportation sequence is indeed neither desirable nor beneficial.

2. AR 70-44 and AR 70-47 have assigned transportability guidance and criteria tasks to USATEA. TEA plans to perform those tasks in a cooperative and inte participating manner to insure that supply and packaging considerations are applied to produce workable and genuinely beneficial results. Recent Army projects on Shock Index, Cargo Restraints and Containerized Ammunition have shown the worth of technical interaction. Other projects as Test Procedures, Criteria, and Test Plans show areas where more participation is required to produce the best possible output.

3. Responsibilities and assignments contained in AR 70-44 and AR 70-47 will be pursued. Coordination and interaction will be initiated primarily through the transportability Agents of the Services. Priority projects will include test procedures, stuffing tests, shock index, and prototype and hardware implementation where required.

Session E

Mr. Raymond H. Stecklein, Chief,
Packaging Branch
Q.A. Division,
DCSC

Mr. Stecklein discussed various aspects of the DCSC interest in packaging documentation for procurement, and in constantly reviewing and improving this documentation. Points discussed were:

1. In prescribing preservation and packaging, packing, palletization, and marking (PPP&M) requirements for procurement documents, essential criteria were: (a) "In the clear" requirements for complete understanding by buyer, vendor, and QAR, (b) Not require other supplemental documents for interpretation, (c) Applicable to more than one FSN, (e) Adaptable to ADP (e) Be in a familiar format, and (f) Be in conformance with existing regulations. The method selected was the use of DCSC Packaging Data Sheets. Originally, DCSC had developed 163 different Packaging Data Sheets; however, with time and experience these were consolidated and reduced to 107.

2. For adequate communication and standardization, the terminology used in the packaging data sheets were those in MIL-STD-129 and MIL-P-116, as these were the most common documents referenced in the DoD system. The format is essentially that used in commodity specifications, and consists of the scope, applicable documents, packaging requirements (up to and including the intermediate container), packing, palletization, and marking.

3. In use of the Packaging Data Sheet System, the packaging specialist associates the characteristics of any new FSN item with the appropriate data sheet which will provide the PPP&M requirements to meet the handling, storage, and shipping cycle for the item. This data is then computerized under SAMMS (Standard Automated Materiel Management Data System) and stored in the data bank for

future use. For any procurement, the procurement office can then call out the pre-established packaging requirements for the FSN item, and the data will be transmitted directly from the computer as a print-out on the procurement document which has been designed to accept the required packaging data.

4. Experience has been excellent with the Packaging Data Sheet Concept, and other military activities and the vendors have expressed a preference for the packaging data sheet over other means of issuing packaging requirements. The only major problem has been vendor unwillingness to marking according to MIL-STD-129, which they feel is voluminous and difficult to understand. DCSC has reduced this problem by preparing a working guide for contractors. However, improperly prepared or omitted DD Forms 1387 still remain the predominant problem. Seminars are planned at DCAS to further discuss this and other areas with DCAS and the vendors.

Mr. James R. Green
Packaging Specialist
Office of Transportation and Packaging
DSA-DCAS

Mr. Green discussed various aspects of DCAS interest in defense packaging:

1. DCAS is a nationwide element of DSA with approximately 18,000 military and civilian employees operating through various regions, districts, area offices, and plant offices. Contracts are normally assigned to DCAS, after signing of the contract, for contract administration to assure compliance with the terms and conditions of the contract. The technical and administrative services involved include quality assurance, programs and status surveillance, on-site engineering services, transportation and packaging, payment, and other functions essential for contract completion.

2. By any measure, the DCAS effort is substantial. For FY72, DCAS administered over 166,000 contracts valued at over 48 billion dollars, 1/3 of which were Army contracts. Assuming an average packaging cost of 10%, DCAS estimates approximately 1/3 billion dollars were expended on packaging for the applicable Army contracts in FY72. By weight, Army contracts amounted to 418 million pounds at a transportation cost of 8.4 million dollars.

3. DCAS packaging administration consists of the following functions:

a. Pre-award survey - to include evaluation of experience and training of contractor personnel, availability of required documents, functional effectiveness of equipment/facilities, and liaison procedures.

b. DCAS Contract Review for Packaging, to identify new/inexperienced contractors, new/unusual packaging requirements, and missing, inadequate, erroneous, or excessive technical requirements. Evaluate relative level of effort and expertise required, the degree of details given in packaging data sheets and packaging codes versus the extent to which the contractor must perform package design engineering and test and evaluation functions.

c. Cost/Price evaluation to determine (1) the necessity for costs as related to contractual requirements, DoD policy, and Federal Regulations, (2) the reasonableness of costs, whether technically legitimate and necessary, and (3) the allocability of costs, whether direct or indirect/hidden.

d. Loss and Damage Prevention, to include preparation, investigation, and analysis of deficiency reports as applicable.

e. Plant Clearance of Industrial Plant Equipment, (IPE) to include technical advice and service by DCAS packaging specialists, to provide instructions for preparation for safe shipment, and evaluation of Packaging, Crating and Handling (PCH) costs.

f. Packaging Services Contract administration, to evaluate costs for availability of convenient sources of military packaging to provide professional performance of military packaging requirements.

g. Packaging - Technical assistance, to contractor personnel in performance of specified packaging, and to government personnel, QA personnel, and procurement personnel as required.

4. The DCAS packaging specialist bridges the gap between the military buyer and the military supplier to assist the contractor in the understanding and performance

of packaging specified by the procurement activity. This includes (a) information on the logistic hazards incident to a specific shipment, (b) evaluation of packaging instructions in terms of technical adequacy, efficiency, effectiveness and economy, (a) physical examination of the item prior to packaging, when necessary, and (d) discussion of item characteristics with the contractor specialists to determine item needs for protective packaging.

Accomplishment of the DCAS packaging specialists activities included over 5000 actions, such as contracts reviewed, pre-award surveys, formal Post Award Conferences, Contractor Packaging Practices Surveys, pricing evaluations, technical recommendations submitted, and Industrial Plant Equipment (IPE) items receiving Packaging Instructions. Cost savings reported in FY72 for packaging and transportation costs were over 6 million dollars, which was achieved, along with other supporting services, with relatively limited manpower resources.

5. One of our more ambitious future plans is the development of a program which will encourage and promote, within each major industrial area, the establishment and use of packaging and consolidation services contractors. This will permit the acceptance of commercial packaging, which, when required, may be shipped to the packaging services contractor to perform the required military packaging, packing, marking, and consolidation of shipments. This cycle has the potential of reducing the cost of both packaging and transportation, while permitting greater use of containerized transportation from source to customer.

Session F.

Mr. H. Lanier Hickman, Jr.,
Deputy Administrator for Solid Waste Management,
Environmental Protection Agency

Solid waste is generated in the U.S. at a rate of 100 pounds per capita per day. Of this portion approximately 10 pounds per capita per day is generated in the urban complexes of the U.S. The remaining portion (90 pounds) results from agricultural and mineral activities.

Packaging materials account for an estimated 13% of the solid waste originating from urban centers. Further, packaging consumption is increasing at an annual rate of 26%, twice our population increase. It is obvious then that packaging materials represent an even increasing and significant fraction requiring proper management by solid waste management systems. Annual costs to presently manage this portion of the waste stream approximates $\$450 \times 10^6$.

What has brought so much attention to packaging and solid waste management is its presence in the storage can behind the back door and its high visibility in litter. Neither of these manifestations represent necessarily an industry gone beserk, rather it is representative of far more significant social deficiencies requiring action by the American public related to solid waste management, packaging, and natural resources.

Mr. Donald Jermain
Manager Pollution Abatement R&D
Naval Supply Systems Command

Mr. Jermain discussed Naval Supply Systems Command interest in various aspects of pollution abatement activities:

1. Responsibility for all research and development efforts, within the Naval Supply Systems Command, related to the Navy Environmental Protection program.

2. Formulation, implementation, and subsequent management of projects as required to develop solutions to pollution problems.

3. Major projects currently underway are:

a. Navy Packaging Reduction Program - Subsistence, approximately $200,000 by Naval Logistics Engineering Group, Naval Ship Research & Development Laboratory and Natick Laboratories.

b. Navy Packaging Reduction Program - Other, approximately $50,000 by Naval Ship Research and Development Laboratory, Annapolis, Md.

c. Naval Waste Oil Handling Program - Approximately $200,000 by a major integrated oil company.

d. Liquified Petroleum Gas vs. Gasoline Exhaust Study for Materials Handling Equipment, Approximately $15,000 by Naval Logistics Engineering Group, Cheatham Annex, Va., Naval Supply Center, Charleston, South Carolina.

4. Coordinated Office of Naval Materiel operations research study of Navy oil pollution of the environment by shore based activities.

Mr. Jesse D. Hill
Packaging Technologist
Systems Development Branch
Packaging Division, NLABS

In response to a Navy request, NLABS entered into an inter-service contract to reduce the amount of packaging and packing material that has to be disposed of aboard ship.

The objectives of this program are:

1. To reduce subsistence related waste on board Navy ships by eliminating or minimizing packaging materials and to make as much of the remaining materials as reusable as possible.

2. To alter required packaging materials to facilitate shipboard disposal.

The established goals are to reduce the packaging material on board ship by 50% in 5 years and by 75% in 15 years.

The following approaches are being taken simultaneously: 1. Substitution of related FSN items, 2. Use of lighter weight materials such as flexible packages. 3. Utilization of shrink wrapping. 4.. Redesign of packaging, 5. Use of biodegradable packaging. 6. Use of returnables.

Recommendations are submitted in light of the following considerations: 1. Industry capability, 2. Technical aspects. 3. Costs, 4. User preference, 5. Shipboard handling constraints.

Total recommendations submitted could, if acceptable, result in a reduction of 3 million pounds of packaging material. This figure represents approximately 20% of the total weight of packaging materials required by the Navy and approximately 25% of the long-term goals.

Future effort will involve field testing of specific items in normal Navy replenishment operations and continued effort in reducing the amount of packaging materials that will be required.

Maj. Jerry L. Gregg
Army Staff Monitor for Environmental Quality R&D
U.S. Army Research Office

Pollution Abatement Considerations in Packaging R&D

The magnitude of the waste disposal problem associated with military packaging materials becomes evident from some of the facts presented at this conference. It was noted that the Army spends $500 million per year on packaging. Eventually all the material utilized in that effort will be discarded and must be disposed of in an acceptable manner. Legislation and regulations prohibiting or restricting open burning and placing stringent controls on incineration and landfills require fresh and innovative approaches to our development, use, and disposal of packaging materials.

Unfortunately many of the characteristics cultivated in packaging materials to increase their utility are not necessarily compatible with simple disposal processes. Additives may be used or new materials developed to provide material that is waterproof, fireproof, insectproof, or resistant to fungus or combinations of these. Reinforcements may be added to increase the strength. Any of these may cause problems relative to recycling, reuse, secondary uses, or ultimate destruction.

There are various possible approaches to mitigating the packaging disposal problem. Reduction in the total volume used would be an important first step. This can be accomplished by development of equipment items that are "self-preserving", i.e. requiring little or no packaging; by increasing the use of bulk rather than individual packaging; and by improving methods of packaging such that less material is required to achieve the same

degree of protection. Another approach is increasing the use of reusable containers. These can range from sturdy metal containers which are reused many times to a "round-trip" container which can be disposed of or recycled at the point of origin. Packaging material which is easily adapted to secondary use solves two problems: disposal of the packaging material, and satisfaction of the secondary need. Finally, disposal problems can be lessened considerably if the bulk of packaging material is amenable to collection and recycling.

If this packaging waste problem is to be solved in the most economical and rational manner, consideration of the problem must begin prior to accumulation of the material on the trash heap. Whenever new packaging materials are developed, or old ones modified; or preservatives, coatings or other additives applied; or new procedures instituted; consideration must be given to the impact on the disposal or reuse of the material involved. A third dimension must be added to the decision making process. Besides the traditional factors of cost and effectiveness, one must consider the environmental consequences. Thinking must be broadened to include not only the effect of the environment on packaging but also the effect of packaging on the environment.